



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### Astronomia Extragalattica (blended)

2021-1-F5801Q049

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#### Aims

Knowledge of the structure of galaxies. Comprehension of the fundamentals of the dynamics of complex stellar systems. Analytical and numerical derivation of gravitational potentials generated by mass distributions. Distribution function analysis for highly-symmetric systems. Understanding of the dynamical secular processes driving the evolution of galaxies and other stellar structures. Knowledge and usage of numerical simulation techniques.

#### Contents

Galactic dynamics. Introduction to N-body numerical simulations. Introduction to the physics of galaxy clusters.

#### Detailed program

Introduction to galactic dynamics. The two body problem. Introduction to direct N-body codes. Potential theory. Simulation of the collapse of a homogeneous sphere. Introduction to galaxies: morphology and dynamics. Introduction to tree-codes, Orbits in spherical and axisymmetric potentials. Introduction to the Toomre parameter and simulation of a stellar disc fragmentation. Introduction to the distribution function. Collisionless Boltzmann equation. Jeans and virial equations. Jeans theorem. Derivation of the distribution functions for spherically symmetric systems. Simulation of a Plummer sphere in equilibrium. Relaxation processes. Two-body relaxation time. Dynamical friction. Introduction to the physics of galaxy clusters.

#### Prerequisites

Undergraduate degree in physics

## **Teaching form**

Blended learning

During the Covid-19 emergency period the lectures will be given in a remote and asynchronous form, with some synchronous events in videoconference.

## **Textbook and teaching resource**

Galactic Dynamics - Binney & Tremaine – Princeton series in Astrophysics. Videos and articles on the e-learning page of the course

## **Semester**

First semester

## **Assessment method**

Oral exam. The oral will focus on a specific topic of galactic dynamics previously agreed between the student and the professor.

During the Covid-19 emergency period the oral exams will be telematic only. The public link for attended will be posted on the e-learning web-page of the course.

## **Office hours**

Monday from 16 to 18

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